I claim:

1. A rate responsive implantable pacemaker comprising:

a sensor for sensing intrinsic activity in a patient's heart and generating a sensed signal;

a pace generator generating pacing signals on demand in response to pacing commands;

a metabolic demand detector detecting a metabolic demand of said patient and generating a metabolic demand parameter;

a respiration detector detecting a respiration of said patient and generating a respiration parameter;

an adjuster circuit receiving said metabolic parameter and said respiration parameter and adjusting said metabolic parameter cyclically in accordance with said respiration parameter to generate a metabolic parameter; and

a controller receiving said sensed signal and said adjusted metabolic parameter to generate said command, whereby said pace generator generates said paces dependent on the patient's respiration.

2. The pacemaker of claim 1 wherein said metabolic demand parameter is dependent on a minute volume.

3. The pacemaker of claim 1 wherein said respiration parameter is based on a minute volume.

4. The pacemaker of claim 1 wherein adjusting circuit generates said adjusted metabolic parameter by cyclically adding and subtracting a constant value from said metabolic parameter, in accordance with said respiration parameter.

5. The pacemaker of claim 1 wherein said adjusting circuit varies said adjusted metabolic parameter linearly between a baseline and one of a maximum value and a minimum value.

6. The pacemaker of claim 5 wherein said base line corresponds to said metabolic parameter.

7. The pacemaker of claim 5 wherein said adjusting means adjusts said adjusted metabolic parameter based on one of said patient's exercise level, age and fitness level.

8. The pacemaker of claim 7 further comprising an exercise level detector for detecting said exercise level.

9. The pacemaker of claim 7 further comprising a memory for storing the patient's age and fitness level.

10. An implantable pacemaker comprising:

a cardiac sensor for sensing intrinsic cardiac activity in a patient's heart and generating sensed signals;

a pacing generator for generating pacing pulses in response to commands;

a respiration sensor for sensing a respiration of said patient and generating respiration signals; and

a controller receiving said sensed and respiration signals and generating in response said commands.

11. The pacemaker of claim 10 wherein said controller generates said commands for pacing said heart at a base pacing parameter, said pacemaker further comprising a rate adjusting circuit for adjusting said commands to pace said heart at an adjusted rate from said base rate, said adjusted rate being dependent on said respiration signal.

12. The pacemaker of claim 11 wherein said adjusting circuit adjusts said base rate by cyclically adding and subtracting a level from said base rate in synchronism with said respiration signal.

13. The pacemaker of claim 12 wherein during a period between adding and subtracting said level to said base rate, said adjusting circuit leaves said base rate unchanged.

14. The pacemaker of claim 10 wherein said adjuring circuit adjusts said adjusted rate gradually between an upper limit and a lower limit.

15. The pacemaker of claim 14 wherein said respiration signal includes peaks alternating with valleys, said peaks and valleys defining inspiration and expiration periods for said respiration and wherein said upper and lower limits of said adjusted rate substantially coincide with said peaks and valleys respectively.

16. The pacemaker of claim 11 wherein said adjusting circuit adjusts said adjusted rate by adding and subtracting a level A to and from said base rate.

17. The pacemaker of claim 16 further comprising an exercise detector for detecting an exercise period of said patient, said level A being dependent on said exercise period.

18. The pacemaker of claim 17 wherein said level A decreases in the presence of exercise.

19. The pacemaker of claim 17 wherein said level A decreases when said patient exceeds a preselected exercise level.

20. The pacemaker of claim 18 wherein said level A is decreased linearly from a first value to a second value as the pacing rate increases between a first heart rate and a second heart rate due to exercise.

21. The pacemaker of claim 20 wherein said adjusting circuit ceases adjusting the base rate when said heart rate increases above a preselected threshold.

22. The pacemaker of claim 18 wherein said level A decreases from a first amplitude to a second amplitude when the patient's exercise level increases above a preselected threshold.

23. The pacemaker of claim 10 wherein said respiration detector includes a transthoracic impedance sensor for sensing a transthoracic impedance of said patient, said transthoracic impedance being dependent on said respiration.

24. The pacemaker of claim 10 further comprising a metabolic detector for detecting a metabolic demand parameter indicative of the metabolic parameter, said controller receiving said metabolic demand parameter for generating said commands.

25. The pacemaker of claim 24 wherein said metabolic demand parameter is dependent on the minute volume.

26. The pacemaker of claim 10 further comprising a transthoracic impedance detector for detecting a transthoracic impedance signal, said respiration detector deriving said respiration signal from said transthoracic impedance signal.

27. The pacemaker of claim 26 further comprising a metabolic demand detector for detecting a metabolic demand of said patient,

28. The pacemaker of claim 27 wherein said metabolic parameter is a minute volume.

29. The pacemaker of claim 28 wherein said metabolic demand detector generates said minute volume from said transthoracic impedance signal.

30. The pacemaker of claim 29 wherein said controller generates said base rate from said minute volume.

31. The pacemaker of claim 30 further comprising an exercise detector for detecting an exercise level of said patient.

32. The pacemaker of claim 31 wherein said adjusting means decreases the level of adjustment with increased exercise level.

33. The pacemaker of claim 31 wherein said exercise detector detects said level of exercise from said metabolic demand.

34. The pacemaker of claim 10 further comparing a memory for storing an age of said patient.

35. The pacemaker of claim 34 wherein said adjuring circuit modifies the level of adjustment of said base rate with increased patient age.

36. The pacemaker of claim 10 further comprising a memory for storing a fitness level of said patient.'

37. The pacemaker of claim 36 wherein said adjusting circuit modifies the level of adjustment of said rate based on said fitness level.

38. A method of controlling the pacing rate of a pacemaker implanted in a patient, said method comprising the steps of :

generating a base pacing parameter for said pacemaker;

detecting a respiration for the patient;

adjusting said base pacing parameter in accordance with said respiration to derive an adjusted pacing parameter; and

generating pacing commands in accordance with said adjusted pacing parameter.

39. The method of claim 38 wherein said step of adjusting said base pacing parameter comprises changing said base pacing

parameter between an upper and a lower limit in synchronism with said respiration.

40. The method of claim 39 wherein said step of adjusting comprises adding and subtracting a level P to and from said base pacing parameter.

41. The method of claim 40 wherein said step of adjusting comprises leaving said base pacing parameter unchanged between said adding and subtracting.

42. The method of claim 39 wherein said step of adjusting said base pacing parameter comprises the step of increasing said base pacing parameter gradually from a nominal value to a peak value.

43. The method of claim 42 wherein said step of increasing is followed by a step of gradually reducing said base rate from said peak value to a bottom value.

44. The method of claim 43 wherein said respiration has peaks and valleys and wherein said peak value substantially corresponds timewise to said peak.

45. The method of claim 42 further comprising sensing a level of exercise of said patient, and wherein said peak value is changed in response to said level of exercise.

46. The method of claim 42 further comprising adjusting said peak value in accordance with an age of said patient.

47. The method of claim 42 further comprising adjusting said peak value in accordance with a physical fitness level of said patient.

48. The method of claim 42 further comprising sensing a metabolic demand of said patient, said base pacing parameter being dependent on said metabolic demand.